

**CLAIMS**

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

- 1        1. A method for reducing motion artifacts and  
2        patient dose in radiological imaging using four  
3        dimensional computed tomography (4D CT), comprising  
4        the steps of:  
5                identifying artifacts in 4D CT images of an  
6                anatomy being imaged, said image artifacts being  
7                responsive to irregularities in a periodic motion  
8                of said anatomy;  
9                measuring said periodic motion of said anatomy  
10              so as to detect said irregularities;  
11              controlling a 4D CT scan of said anatomy so as  
12              to pause the scan during periods having said  
13              detected irregularities.
- 1        2. A method as in claim 1, wherein said anatomy is  
2        a lung and said measuring step uses a respiratory  
3        signal.
- 1        3. A method as in claim 2, wherein said measuring  
2        step further comprises the steps of:  
3                recording said respiratory signal over a  
4                plurality of breathing cycles; and  
5                constructing an envelope of spatial and  
6                temporal tolerances, wherein regular ones of said  
7                plurality of breathing cycles are within said  
8                envelop and irregular ones of said plurality of  
9                breathing cycles extend beyond said envelope.

1       4. The method of claim 3, wherein said controlling  
2       step further includes the steps of:  
3             acquiring a respiratory signal during said 4D  
4       CT scan;  
5             applying said envelope to said respiratory  
6       signal; and  
7             adapting said 4D CT scan to said respiratory  
8       signal by excluding from said 4D CT scan data  
9       acquired when said respiratory signal is not within  
10      said envelope.

1       5. The method of claim 4, wherein data acquired  
2       during irregular respiratory cycles is excluded by  
3       pausing said 4D CT scan data acquisition when said  
4       respiratory signal is not within said envelope.

1       6. A system for reducing motion artifacts and  
2       patient dose in radiological imaging using four  
3       dimensional computed tomography (4D CT),  
4       comprising:  
5             means for identifying artifacts in 4D CT  
6       images of an anatomy being imaged, said image  
7       artifacts being responsive to irregularities in a  
8       periodic motion of said anatomy;  
9             means for measuring said periodic motion of  
10      said anatomy so as to detect said irregularities;  
11             means for controlling a 4D CT scan of said  
12      anatomy so as to pause the scan during periods  
13      having said detected irregularities.

1       7. A system as in claim 6, wherein said anatomy is  
2       a lung and said measuring means uses a respiratory  
3       signal.

1       8. A system as in claim 7, wherein said measuring  
2 means further comprises:

3           means for recording said respiratory signal  
4 over a plurality of breathing cycles; and  
5           means for constructing an envelope of spatial  
6 and temporal tolerances, wherein regular ones of  
7 said plurality of breathing cycles are within said  
8 envelop and irregular ones of said plurality of  
9 breathing cycles extend beyond said envelope.

1       9. The system of claim 8, wherein said controlling  
2 step further comprises:

3           means for acquiring a respiratory signal  
4 during said 4D CT scan;  
5           means for applying said envelope to said  
6 respiratory signal; and  
7           means for adapting said 4D CT scan to said  
8 respiratory signal by excluding from said 4D CT  
9 scan data acquired when said respiratory signal is  
10 not within said envelope.

1       10. The system of claim 9, wherein data acquired  
2 during irregular respiratory cycles is excluded by  
3 pausing said 4D CT scan data acquisition when said  
4 respiratory signal is not within said envelope.

1       11. A method for reducing motion artifacts in  
2 radiological imaging using four dimensional  
3 computed tomography (4D CT), comprising the steps  
4 of:

5           identifying artifacts in 4D CT images of an  
6 anatomy being imaged, said image artifacts being

7 responsive to irregularities in a periodic motion  
8 of said anatomy;  
9 measuring said periodic motion of said anatomy  
10 so as to detect said irregularities;  
11 controlling post-processing of a 4D CT scan of  
12 said anatomy so as to omit data acquired during  
13 periods having said detected irregularities.

1 12. A method as in claim 11, wherein said anatomy  
2 is a lung and said measuring step uses a  
3 respiratory signal.

1 13. A method as in claim 12, wherein said  
2 measuring step further comprises the steps of:  
3 recording said respiratory signal over a  
4 plurality of breathing cycles; and  
5 constructing an envelope of spatial and  
6 temporal tolerances, wherein regular ones of said  
7 plurality of breathing cycles are within said  
8 envelop and irregular ones of said plurality of  
9 breathing cycles extend beyond said envelope.

1 14. The method of claim 13, wherein said  
2 controlling step further includes the steps of:  
3 acquiring a respiratory signal during said 4D  
4 CT scan;  
5 applying said envelope to said respiratory  
6 signal; and  
7 adapting said 4D CT scan to said respiratory  
8 signal by excluding during said post-processing of  
9 said 4D CT scan data acquired when said respiratory  
10 signal is not within said envelope.

1        15.    The method of claim 14, wherein data acquired  
2        during irregular respiratory cycles is excluded by  
3        omitting data acquired during said 4D CT scan when  
4        said respiratory signal was not within said  
5        envelope.